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What is claimed is:

1. A selective catalytic reduction apparatus, comprising at least first and last catalyst layers in series for reducing nitrogen oxides in a flue gas;

at least one interstage heat exchanger located after the first layer and before the last layer, that lowers flue gas temperature, and that acts as a mixing body to lower the standard deviation of the NH_3/NO ratio entering catalyst layers after the first catalyst layer, thus providing better consumption of both ammonia and NO_x in the reactor than would be achieved in the absence of the at least one interstage heat exchanger.

2. The selective catalytic reduction apparatus of claim 1, further comprising, in addition to said first and last catalyst layers, a second catalyst layer, wherein the at least one interstage heat exchanger is located between the second and third catalyst layers.

3. The selective catalytic reduction apparatus of claim 1, further comprising, in addition to said first and last catalyst layers, a second catalyst layer and a third catalyst layer, wherein the at least one interstage heat exchanger is located between the first and second, second and third, or third and last catalyst layers.

4. The selective catalytic reduction apparatus of claim 1, further comprising, in addition to said first and last catalyst layers, a second catalyst layer, a third catalyst layer and a fourth catalyst layer, wherein the at least one interstage heat exchanger is located between the first and second, second and third, or third and fourth, or fourth and last catalyst layers

5. The selective catalytic reduction apparatus of claim 1 wherein the catalyst composition is not altered to accelerate or decelerate any reactions.

6. The selective catalytic reduction apparatus of claim 1 wherein 50-175°F of temperature are transferred out of the flue gas.

7. The selective catalytic reduction apparatus of claim 1, further comprising a compressed depth Ljungstrom air heater with a semi-continuous two piece air heater basket, or a continuous one piece air heater basket.

8 The selective catalytic reduction apparatus of claim 1 wherein the apparatus is configured to utilize a NH_3/NO ratio approaching unity.

9 The selective catalytic reduction apparatus of claim 1, further comprising at least one additional mixing device located between at least two catalyst layers to further mix reagent and NO.

10. The selective catalytic reduction apparatus of claim 9, wherein the additional mixing device is a static mixing device.

11. The selective catalytic reduction apparatus of claim 10, wherein the static mixing device is a perforated plate or plates.

12. The selective catalytic reduction apparatus of claim 1, further comprising an additional layer to a special-purpose catalyst for oxidation of mercury, of a composition such that the lower temperature decreases the SO_2 conversion significantly, but only marginally decreases or does not affect the mercury oxidation, said special-purpose catalyst not being a proportional change in concentration of the ingredients of a conventional SCR catalyst, said special-purpose catalyst having a formulation preferential to Hg oxidation.

13. The selective catalytic reduction apparatus of claim 1, wherein said additional layer of special-purpose catalyst comprises carbon, material formed from fly ash, and/or at least one palladium-based compound.

14. The selective catalytic reduction apparatus of claim 1, further comprising a combustion air bypass duct controlled by a modulating damper to direct combustion air leaving a compressed, one stage air heater directly to a boiler thus bypassing the interstage heater after the first catalyst layer, while retaining a minimum amount of air in the interstage heater exchanger to avoid overheating of tubes, to preserve the gas temperature in the first catalyst layer above a minimum required to avoid ABS deposition, for use at lower loads or at a full load.

15. A method for the selective catalytic reduction of nitrogen oxides, comprising:

introducing a reducing agent into a flue gas containing nitrogen oxides;

then passing the flue gas through at least a first layer of nitrogen oxide reducing catalyst where an amount of nitrogen oxides in said flue gas is reduced;

then passing the flue gas through a heat exchanger that removes heat from the flue gas and also mixes the flue gas and the reducing agent; and

then passing the flue gas through at least one additional layer of nitrogen oxide reducing catalyst where an additional amount of nitrogen oxides in the flue gas is reduced.

16. The method of claim 15 wherein said at least one heat exchanger is at least one interstage heat exchanger, that lowers flue gas temperature, and that acts as a mixing body to lower the standard deviation of the NH_3/NO ratio entering catalyst

layers after the first catalyst layer, thus providing a higher amount of consumption of both ammonia and NO_x in a reactor than would be achieved in the absence of the at least one interstage heat exchanger.

17. The method of claim 16 wherein the at least one interstage heat exchanger transfers 50-175°F of heat; and comprises utilizing a one-piece heat exchange element in a Ljungstrom-type heat exchanger, and wherein ammonium sulfates and ammonium bisulfates are cleaned from air heater surfaces with sootblowers located at both the inlet and outlet of the air heater.

18. The method of claim 15 wherein the reducing medium is ammonia and the NH₃/NO ratio is between 0.90 and 0.98.

19. The method of claim 18 wherein the NH₃/NO ratio is about 1:1.

20. The method of claim 15, further comprising before passing the flue gas through the at least one additional catalyst layer, passing the flue gas through a separate static mixing device to mix reducing agent and NO, further mixing the partially reacted NH₃ and NO.

21. The method of claim 15, further comprising passing the flue gas through at least one additional layer of a special-purpose catalyst for oxidation of mercury, said special-purpose catalyst not representing a proportional change in concentration of the ingredients of a conventional SCR catalyst, said special-purpose catalyst having a formulation preferential for Hg oxidation

22. The method of claim 15, further comprising,
passing a portion of the flue gas through a combustion air bypass duct controlled by a modulating damper to direct combustion air leaving a compressed, one stage air

heater directly to a boiler thus bypassing the interstage heater after the first catalyst layer, while retaining a minimum amount of air in the interstage heater exchanger avoiding overheating of tubes, preserving gas temperature in the first catalyst layer above a minimum required to avoid ABS deposition.

23. The selective catalytic reduction apparatus of claim 17, wherein a lower flue gas temperature by a magnitude of 50 to 175°F lowers the oxidation of SO₂ across each layer by a factor of 50-150%, and/or increases the oxidation of mercury across each layer by a value of 20 to 150%, both compared to the rate that would normally be observed without the reduced flue gas temperature.

24. A selective catalytic reduction apparatus, comprising at least first and last catalyst layers in series for reducing nitrogen oxides in a flue gas;

at least one interstage tube heat exchanger located after the first layer and before the last layer, that lowers flue gas temperature, and that acts as a mixing body to lower the standard deviation of the NH₃/NO ratio entering catalyst layers after the first catalyst layer, thus providing better consumption of both ammonia and NO_x in the reactor than would be achieved in the absence of the at least one interstage tube heat exchanger.

25. A selective catalytic reduction apparatus, comprising at least first and last catalyst layers for reducing nitrogen oxides in a flue gas;

at least one interstage static mixer located after the first layer and before the last layer, that acts as a mixing body to lower the standard deviation of the NH₃/NO ratio entering catalyst layers after the first catalyst layer, thus providing better consumption of

both ammonia and NO_x in the reactor than would be achieved in the absence of the at least one interstage static mixer.